NEC

NEC America, Inc.

N500A DSU/CSU

DIGITAL SERVICE UNIT/ CHANNEL SERVICE UNIT

OPERATOR'S MANUAL

MP MASTER

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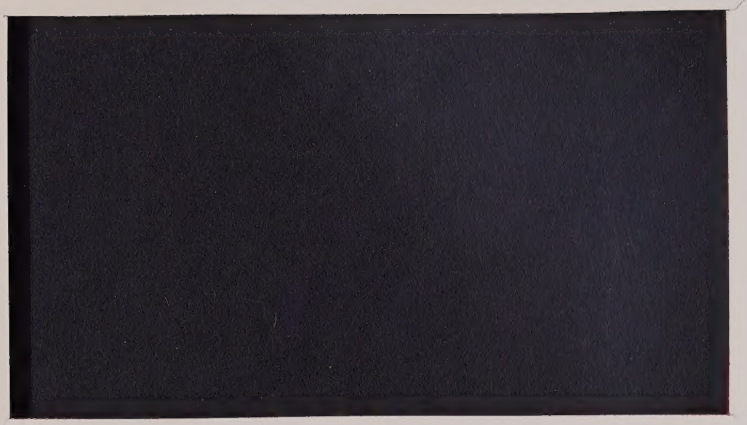
Data and Video Communications Systems



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OPERATOR'S MANUAL

November 1986

PRELIMINARY

NEC America, Inc.
Data Communications Products
110 Rio Robles
San Jose, California 95134
(408) 433-1250

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DOI-E07138

WARRANTY

This NEC product, the N500A DSU/CSU has a warranty against failure resulting from defects in design or workmanship for 1 year. This warranty does not cover defects resulting from misuse, damage in shipment, or damage from natural disasters, Acts of God or other circumstances beyond NEC's control. If the unit fails during the Warranty period, it will either be repaired or replaced at NEC's discretion.

Please attempt to verify that the unit is indeed faulty before requesting a Return Authorization. Conduct any troubleshooting procedures presented in this manual or related documents to isolate and identify the source of the problem. If technical assistance is required, follow the procedures below.

TECHNICAL ASSISTANCE

To report possible problems with NEC equipment and/or to obtain immediate technical assistance over the telephone, contact NEC America, Inc., Data Communications Products, Technical Support Center, at one of these telephone numbers:

(800) 672-3309 ..... California
(800) 538-8166 ..... All other CONUS states
(408) 433-1250 ..... Alaska, Hawaii, Puerto Rico

Important

To ensure prompt service, please have this information available when you call. If there is a HELP! card in the back of this manual, please fill out the card before calling.

1. Your name and telephone number
2. Your company name and address
3. The type of NEC modem or equipment you are using
4. The equipment serial number
5. A telephone number to which the modem is connected (dial-up) OR a telephone number where the modem is located (leased line).
6. The results of any tests you have performed to identify the problem

It is sometimes helpful if you have the equipment instruction manual and/or the modem is available.

WARNING

FCC rules require that you be notified of the following:

1. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications.

2. This device has been tested and found to comply with the items for a Class A computing device pursuant to Subpart J of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commerical environment.

3. If operation of this equipment in a residential area causes interference, the user will be required to do whatever is required to correct the interference, at his own expense.

CONTENTS (CONT'D)

APPENDICES

APPENDIX	TITLE
A	FCC Rules, Part 15
B	NEC RS-232-C Connector Interface Assignments
C	CCITT V.35 Interface Assignments

FIGURES

SECTION	FIGURE	TITLE	PAGE
I	1.1	N500A Front Panel	2
	1.2	LCD Display	5
II	2.1	NON-DDS Installation	2
	2.2	DDS Network Connection	2
	2.3	Rear Panel	3
	2.4	Option Switch Locations	4
	2.5	Rear Panel	11
	2.6	Customer Interfaces	13
	2.7	RS-232-C Interface Card Location	14
	2.8	RS-232-C Interface Case	15
	2.9	Placement of V.35 Interface Card	16
III	3.1	LCD Display Windows	2
	3.2	Normal LCD Display	5
	3.3	LCS, Unit in Test	6
IV	4.1	Analog Loopback Self Test	2
	4.2	Analog Loopback Test	3
	4.3	Local Loopback Test	4
	4.4	Remote Terminal Test	6
	4.5	Loop Back Self Test	7

NEC AMERICA INC.
DATA COMMUNICATIONS PRODUCTS
N500A DSU/CSU
OPERATOR'S MANUAL

CONTENTS

SECTION	TITLE	PAGE
I	GENERAL INFORMATION AND FEATURES	1
1.1	Overview	1
1.2	Front Panel	3
1.3	Specifications	5
II	INSTALLATION AND OPTIONING	1
2.1	Overview	1
2.2	Interface Options	3
2.3	Option Switches	3
	Option Descriptions	6
	Addressing N500A	6
	Data Rate	6
	Clock	7
	Line Type	7
	Bit Buffer	7
	DR in LL Test	8
	System Status (SS)	8
	Circuit Assurance (CA)	8
	Continuous RS	8
	Inhibit Remote Control of LL	9
	Inhibit Remote Control of RT	9
	Inhibit Remote Control of ST	9
	DTE Control of AL	9
	DTE Control of RT	9
2.4	Back Panel Connections	10
2.5	Non-DDS Connections	10
2.6	Circuit Card Replacement	12
III	OPERATION	1
3.1	Overview	1
3.2	Displays	1
3.3	Normal Indications and Displays	5
3.4	Abnormal Indications and Displays	5
IV	DIAGNOSTICS	1
4.1	Overview	1
4.2	Local Tests	2
4.3	Remote Tests	5
4.4	Terminal Control of Testing	8

CONTENTS (CONT'D)

TABLES

SECTION	TABLE	TITLE	PAGE
I	1.1	Status Indicators	3
	1.2	Front Panel Switches	4
II	2.1	Option Summary	5
	2.2	Factory Installed Switch Settings	5
III	3.1	LCD Display Window	1
	3.2	LCD Display Messages	2

Section 1

GENERAL INFORMATION AND FEATURES

1.1 Overview

The N500A Digital Service Unit/Channel Service Unit (N500A DSU/CSU) features reliable digital data transmission at rates up to 56K bps. Although the NEC N500A is designed for use in the DATAPHONE DIGITAL SERVICE Network (DDS), the unit can be readily optioned for point-to-point service over customer provided metallic facilities in a short-haul environment.

The N500A DSU/CSU provides all necessary signal conversions required to transmit a digital signal to the telephone company's serving central office.

The N500A DSU/CSU is compatible with the DDS Network in signaling characteristics, timing, format and control signal response.

In addition, the versatile N500A can be directly connected to the DDS Network without the requirement of an additional interfacing Channel Service Unit (CSU). The capabilities of the CSU are built into the N500A.

Figure 1.1 shows two front views of the N500A. The top view is with the front bezel closed so that only the LCD is shown. In the bottom view, the bezel has been removed to expose the unit's front panel switches, LCD display and LED indicators.

The N500A operates in either full or half duplex and has built-in provisions for rapid fault diagnosis via extensive local and remote test capabilities.

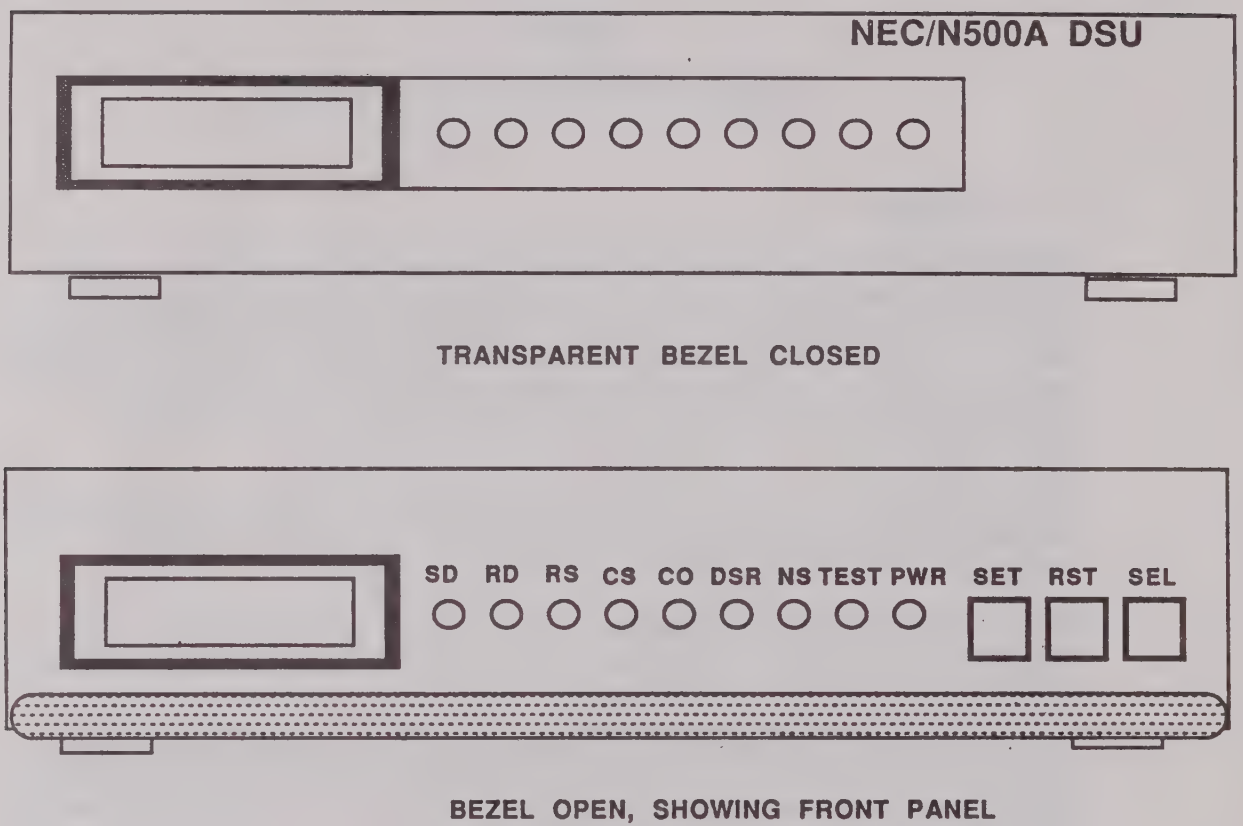

FIGURE 1.1 N500A FRONT PANEL

The N500A can be configured to operate at any of three sub-rates (2.4, 4.8, and 9.6K bps) when the unit is supplied with an RS-232-C interface card.

The 56K bps transmission rate is available to the user by ordering the N500A with a factory installed CCITT V.35 interface card.

1.2 Front Panel

The N500A DSU/CSU front panel includes a LCD display and nine LEDs which indicate the status of the unit's various operations.

LED Indications

Front panel LED indicators are described in the following table. When the LED lights, the described condition applies.

TABLE 1.1

STATUS INDICATORS

INDICATOR	DESCRIPTION	MEANING	DIRECTION
SD	Send Data	Data is transmitting	From local D TE
RD	Receive Data	Data is being received	From remote DSU
RS	Request to Send	DTE wants to transmit	From local DTE
CS	Clear to Send	OK for DTE to transmit	To local DTE
CO	Carrier On	Signal Detected	From remote DSU
DSR	Data Set Ready	Modem ready to send	To local DTE
NS	No Signal	Carrier lost	From remote DSU
TEST	Test	DSU in test mode	From DSU
PWR	Power	DSU powered up	From DSU

Front Panel Push-buttons

Three push-button switches are located behind the removeable bezel on the DSU/CSU front panel. These push-buttons are used to select, activate and deactivate the N500A's built-in self-tests. To access the front panel controls, pull down and out on the top of the facing bezel and let it swing open.

To activate one of the test functions described in Table 1.2 below, depress the associated front panel push-button as described in Table 1.1.

TABLE 1.2
Front Panel Switches

Switch	Function
SET	Activates selected test.
RST	Selection is released and the N500A is restored to normal operation.
SEL	Selects a test in the following order: LCL LL (Local Line loopback) LCL RT (Remote Terminal loopback) LCL AL (Analog Loopback) LCL ST (Self-Test)

NOTE: A flashing display signals that a test mode has been selected (**SEL**) and **SET** but that the test is non-operational or inhibited.

LCD Indications

The LCD display on the front panel provides information on data rate and operational status. During self-testing, a real time error count is displayed. The LCD display is composed of two 16 character rows. The display is divided into four quadrants. Each of these quadrants forms an 'informational window' as labeled in Figure 1.2.

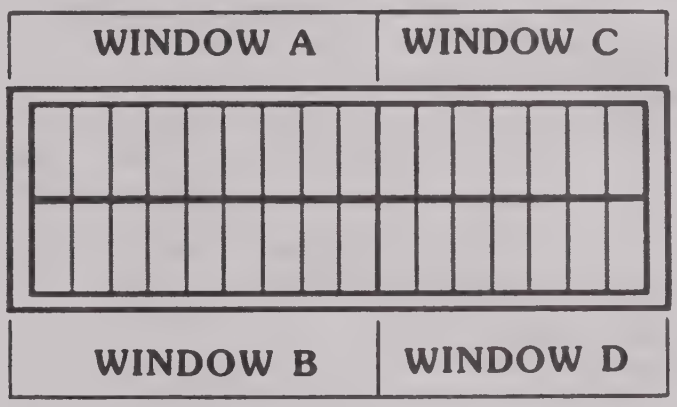

FIGURE 1.2 LCD DISPLAY

1.3 Specifications

Operation Modes
4-wire full duplex, half duplex, simplex

Data Rates

RS-232-C	2400, 4800, 9600 bps
CCITT V.35	56K bps

NOTE: Interface boards are available in both RS-232-C and CCITT V.35 versions.

Line Interface

Line rate: 2.4, 4.8, 9.6 and 56K bps
Impedance: 135 ohm +/-10%
Output level: +6dBm (2.4, 4.8, 56K bps)
0dBm (9.6K bps)
Input level: +6 to -28dBm (2.4, 4.8, 56K bps)
0 to -34dBm (9.6K bps)

Short-haul Cable Requirements

Recommended: Wire Gauge - AWG 24 *
Insulation - Plastic Insulated Cable (PIC)

* Must meet Bell Pub. 62310 specifications.

Short-haul Line Limitations

Speed	Maximum Transmit Distance *
2.4K	11.75 miles
4.8K	8.95 miles
9.6K	6.80 miles
56K	3.70 miles

* Maximum distance based on recommended cable and ambient temperature of 70 degrees F.

DTE Interface

2.4, 4.8, 9.6K bps: (EIA RS-232-C)
56K bps: CCITT V.35

Test Modes

Line Loopback
Remote Terminal Loopback
Analog Loopback
Self-Test (with test pattern generator and error count display)

AC Power
117 volts +/- 10%
60Hz +/- 5%, 13W

Dimensions
Height: 2.4 inches (6cm)
Width: 10.6 inches (27cm)
Depth: 13.8 inches (35cm)

Weight
5.5 lbs. (2.5kg)

Environmental Conditions
Operating temperature: 0 to 40 degrees centigrade
Relative humidity: up to 95% without condensation

SECTION II

INSTALLATION AND OPTIONING

2.1 Overview

This section explains how to check and reset the hardware options and how to install the unit after the option settings have been checked.

There are two interface circuit boards which can be used with the N500A to meet either RS-232-C or CCITT v.35. The correct board has been installed in this unit based upon information provided at the time of purchase. To complete installation, take the following steps.

1. Set hardware options. (Paragraph 2.3)

2. Place the N500A in its permanent location. Be sure the side vents are not obstructed.

3. Connect cables. (Paragraphs 2.4 and 2.5)

   For DTE connections also refer to the Appendices for interface specifications.

   For Connection to communications line, either DDS or non-DDS, also see Figures 2-1 and 2-2.

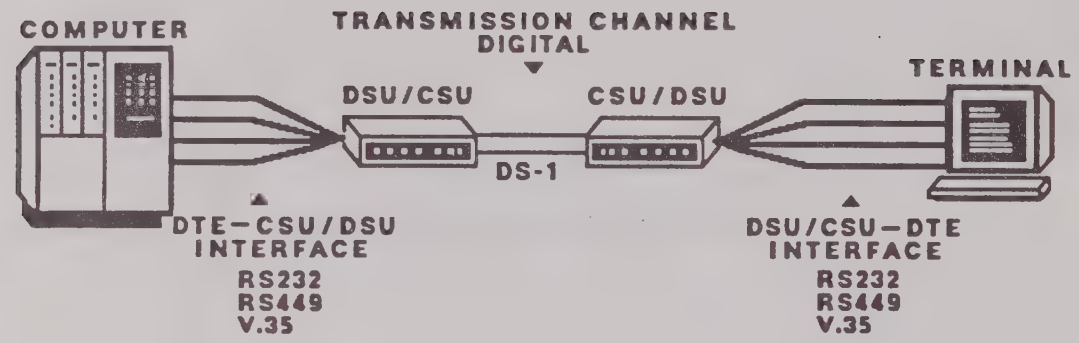

FIGURE 2.1 NON-DDS INSTALLATION

If the DSU/CSU is to be connected to the DDS Network, refer to Figure 2.2.

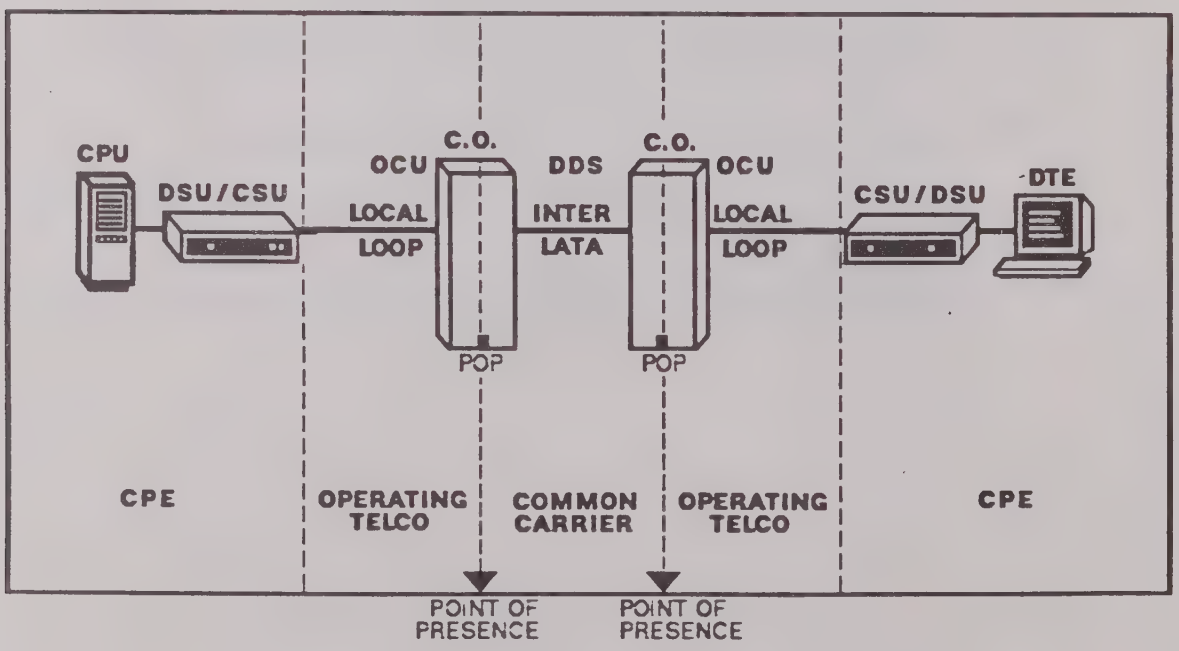

FIGURE 2.2 DDS NETWORK CONNECTION

2.2 Interface Options

Two field replac able interface cards adapt the DSU/CSU to differing network requirements. The N500A can be configured to operate at full data rate (56K bps) or at any of three sub-rates. To operate at 56K bps, the CCITT V.35 (34 pin) connector card is required. The RS-232-C card configures the unit to operate at 2.4K, 4.8K and 9.6K bps.

The balanced interface supplied by the CCITT card's circuitry allows data speeds through the interface at considerably higher speeds than can be obtained using an unbalanced interface such as the RS-232-C.

If you need to install a different circuit card (either CCITT V.35 or RS-232-C) refer to Section 2.6.

2.3 Option Switches

Three banks of DIP switches (SW1, SW2 and SW3) are located inside the N500A DSU/CSU housing. Before removing the N500A cover be certain that the unit's power cord is disconnected.

To remove the N500A cover, loosen the two Phillips head screws on the back panel (see Figure 2.3). Lift up and slide back on the unit's cover to expose the electronic circuitry.

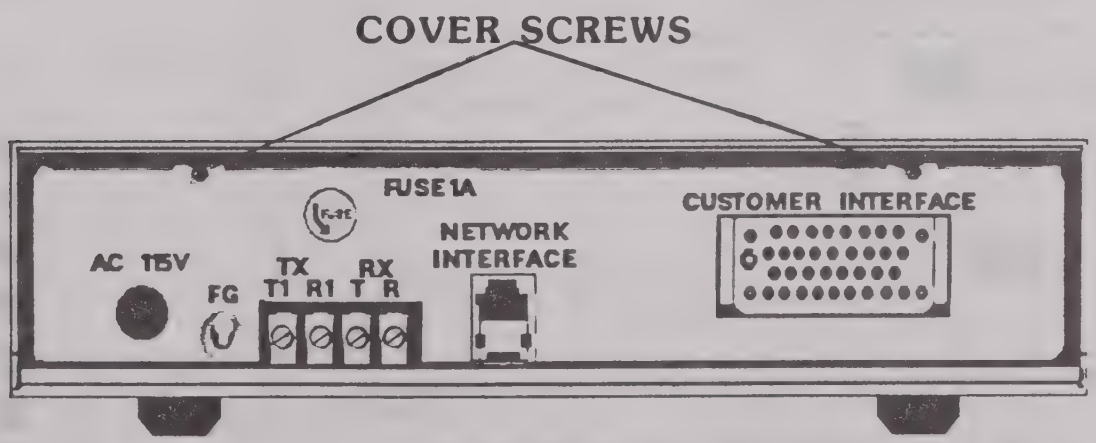

FIGURE 2.3 REAR PANEL

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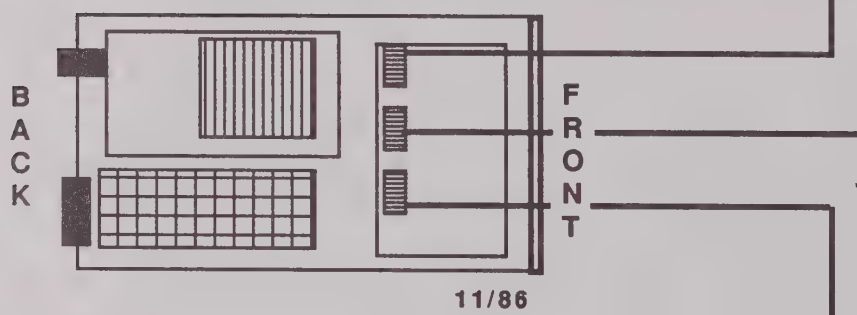
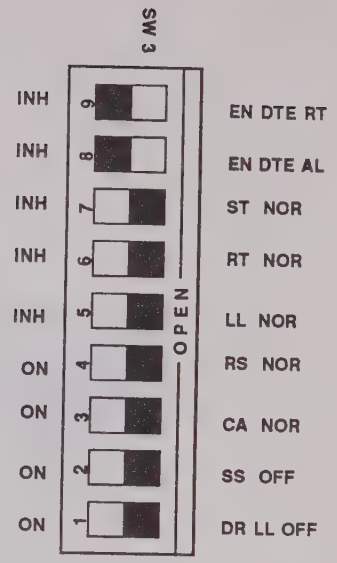
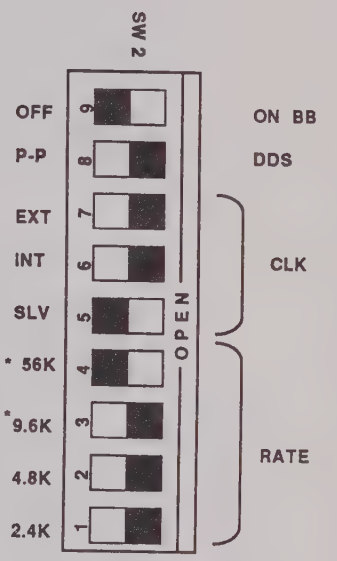
NEC N500A DSU/CSU

The three switches, SW1, SW2, and SW3 control interface signal interpretation, unit address assignment, clocking and line configuration. The switches are located toward the center of the board and are exposed by removing the cover (Figure 2.4). In the drawing below, the board is viewed from the top. The three expanded switch drawings show factory settings and identify switch functions as they are shown on the board. Also see Table 2.1 which summarizes the selectable options. Factory (default) settings are in Table 2.2.

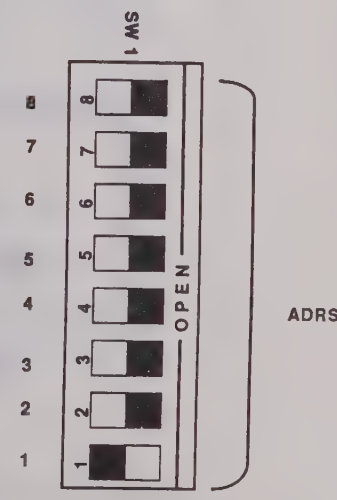
Figure 2.4
OPTION SWITCH LOCATIONS



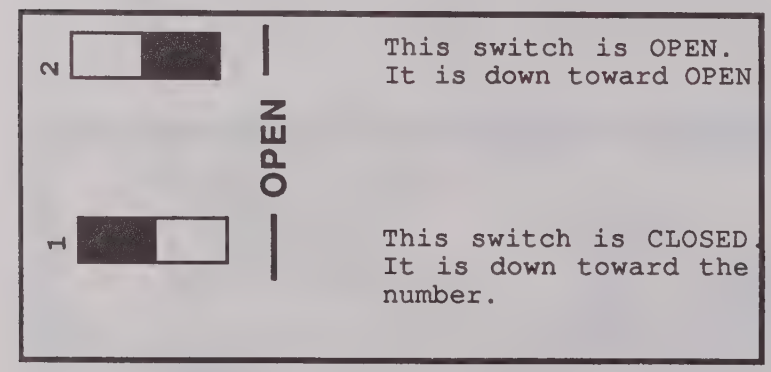




*Note - see Table 2-2



SWITCH EXPLANATION



Do not equate OPEN/CLOSED with an ON/OFF or YES/NO. For some settings, OPEN = ON; In others, OPEN = OFF.

TABLE 2.1
OPTION SUMMARY

The table below cross references the option function with the switch and individual setting. Table 2.2 identifies factory settings.

OPTION	SWITCH	SETTING
Addressing N500A	1	ALL
Data Rate	2	1,2,3,4
Clock	2	5,6,7
Line Type	2	8
Bit Buffer	2	9
DR In LL Test	3	1
System Status (SS)	3	2
Circuit Assurance (CA)	3	3
Continuous Request-to-Send (RS)	3	4
Inhibit Remote Control of LL	3	5
Inhibit Remote Control of RT	3	6
Inhibit Remote Control of ST	3	7
DTE Control of Analog Loopback (AL)	3	8
DTE Control of Remote Terminal (RT)	3	9

11/86

TABLE 2.2
FACTORY SETTINGS

The table below shows the option switch settings for the N500Aas they are preset at the factory. Check settings during installation.

SWITCH 1

POSITION	1	2	3	4	5	6	7	8	
OPEN		✓	✓	✓	✓	✓	✓	✓	
CLOSED	✓								

SWITCH 2

POSITION	1	2	3	4	5	6	7	8	9
OPEN	✓	✓	✓			✓	✓	✓	
CLOSED				✓	✓				✓

SWITCH 3

POSITION	1	2	3	4	5	6	7	8	9
OPEN	✓	✓	✓	✓	✓	✓	✓		
CLOSED								✓	✓

NOTE: Switch 2 - For the V.35 Card, setting 4 is closed. For RS-232-C Card, setting 3 is closed.

11/86

Option Descriptions

Addressing N500A

Switch SW1 is used to give the N500A an address. For testing, each N500A must have an address. There are eight settings on the switch. Each setting has a numerical value, 1 to 8. With all switches OPEN (pushed down toward OPEN) the Address is zero (0). To give the N500A an address, CLOSE just one switch to give the unit an address of 1 to 8.

> For point-to-point configurations, the address of both N500A's must be the same.
>
> For multi-junction configurations, such as DDS, each unit must have a different address.

For multi-junction network testing, the unit closest to the central site should have the lowest address and the other units should have progressively larger address in relation to their distance from the central site. The central site unit's address is one (1) until remote testing required, then it will be set to the same address as the unit being tested.

Data Rate

Switch SW2 (settings 1, 2, 3, and 4) are used to select a transmission data rate. Only one setting can be CLOSED. The values of the CLOSED switch are shown below and on the circuit board next to the switch.

SW2-4 = 56k bps (Factory setting for V.35 interface)
SW2-3 = 9.6k bps (Factory setting for RS-232-C)
SW2-2 = 4.8k bps
SW2-1 = 2.4k bps

Clock

Switch SW2 (settings 5, 6, and 7) is used to set the timing mode. For DDS configurations, CLOSE SW2-5. This is required on all DDS lines.

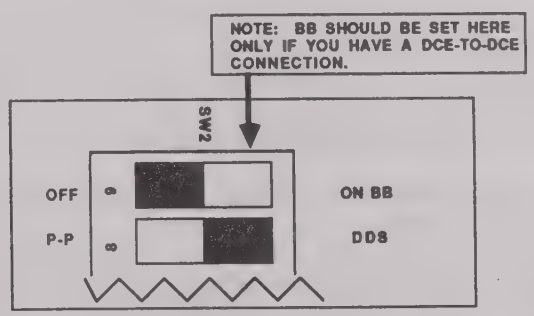
For non-DDS connections, CLOSE either SW2-6 or SW2-7 depending upon terminal configuration.

SW2-5 = Slave (from line side) (Factory setting)
SW2-6 = Internal (from N500A)
SW2-7 = External (from terminal)

Line Type

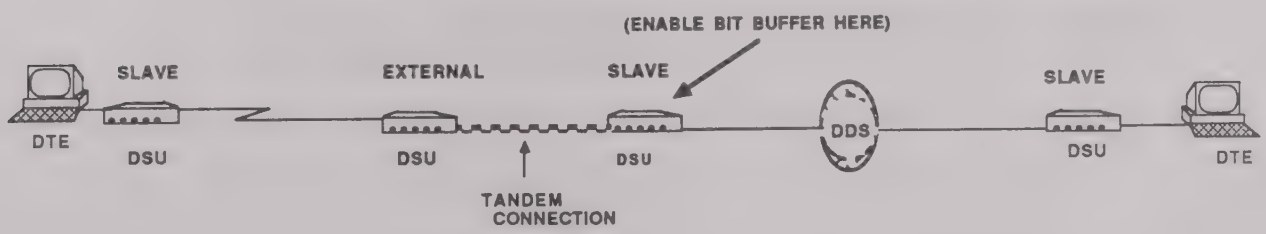
Switch SW2 (setting 8) is used to select either point-to-point (P-P) lines or DDS operation. (Point-to-point refers to non-loaded metallic lines or L.A.D.S. lines).

OPEN = DDS (Factory setting)
CLOSED = point-to-point (P-P)



Bit Buffer

SW2 (setting 9) is used to enable or disable the buffer, i.e., buffer between two out-of-phase clock sources. This option is used in conjunction with the Clock option. The buffer should be enabled in all tandem connection applications where DSU's are cabled back-to-back.



DR in LL Test

SW3 (setting 1) controls Data Set Ready (DSR) during Line Loopback (LL) Test.

OPEN = DSR is OFF (low) during LL (Factory setting)
CLOSED = DSR is ON (high) during LL

If SW3-1 is CLOSED during LL, the DTE receives no indication that the N500A is being tested.

System Status (SS)

Switch SW3 (setting 2) controls DSR during normal operation.

OPEN = DSR is constantly ON except during testing (Factory setting)
CLOSED = DSR is OFF when the line connection is faulty or distrupted, i.e., No Signal (NS) indicator is ON.

Circuit Assurance (CA)

Switch SW3-3 controls Clear-to-Send (CS).

OPEN = CS controlled only by Request-to-Send (RS) (Factory setting)
CLOSED = CS is OFF when Carrier Detect (CD) is OFF, even if RS is ON. CS will still turn OFF when RS is OFF.

Continuous RS

If RS is forced continuously ON, a line signal is constantly sent from the N500A. This permits terminals without RS capability to communicate.

OPEN = RS controlled by DTE (Factory setting)
CLOSED = RS is forced continuously ON (high)

Inhibit Remote Control of LL

Switch SW3 (setting 5) is used to control loopback testing from remote sites.

OPEN = Test can be initiated either from local or telephone company (Factory setting)
CLOSED = Test can only be initiated from local end

Inhibit Remote Control of RT

Switch SW3 (setting 6) determines source of RT testing.

OPEN = Test is initiated from either end (Factory set)
CLOSED = Test is only initiated from local N500A and inhibits the telephone co.from making the test.

Inhibit Remote Control of ST

Switch SW3 (setting 7) controls initiating ST.

OPEN = Test can be run from either end (Factory setting)
CLOSED = Test can only be initiated from local N500A and inhibits the remote line from making the test.

DTE Control of Analog Loopback (AL)

Switch SW3 (setting 8) is used to determine if the AL is oontrolled from DTE or from the N500A.

OPEN = Test can be initiated from either the DTE or the N500A
CLOSED = AL is initiated only from N500A front panel (Factory setting)

DTE Control of Remote Terminal (RT) Loopback

Switch SW3 (setting 9) is used to determine if RT is controlled from DTE or from the N500A.

OPEN = Test is controlled from either the DTE or the N500A
CLOSED = Test is only controlled from the N500A (Factory setting)

2.4 Back Panel Connections

The N500A DSU/CSU connects to standard 117v AC power. The unit requires a three pronged grounded outlet and draws 13 watts.

Line Connection

Pin assignments for the 8 position modular DDS interface connector on the unit's back panel are as follows.

Pin	Description
8	Receive Signal(R)
7	Receive Signal(T)
2	Transmit Signal(R1)
1	Transmit Signal(T1)

2.5 Non-DDS Connections

The N500A DSU/CSU is designed for operation on non-loaded metallic circuits. The unit will not operate properly on 3002 lines (analog facilities). If a balanced bridge is provided, the unit can be used in either point-to-point or multi-point applications.

Cable Requirements

Short-haul transmission distances are limited because the unit has finite carrying capacity without the benefit of line drivers. Connecting cables must meet Bell Publication Specifications (62310). A cable's carrying capability for a given distance is a function of the following four factors:

- cable size
- insulation
- ambient temperature
- data rate

Given a recommended cable with respect to wire gauge and insulation type (AWG 24, PIC, twisted pairs), the following maximum transmission distances apply.

Speed	Maximum Transmit Distance *
2.4K	11.75 miles
4.8K	8.95 miles
9.6K	6.80 miles
56K	3.70 miles

* Maximum distance based on recommended cable and ambient temperature of 70 degrees F.

Connectors

In typical DDS network connections, the 8 pin modular connector links the N500A to the circuit. However, screw terminals are provided for connection to customer provided wire facilities (Figure 2.5). Terminals are labeled on the back panel to indicate Receive (RX) and Transmit (TX) wires T, R, T1 and R1.

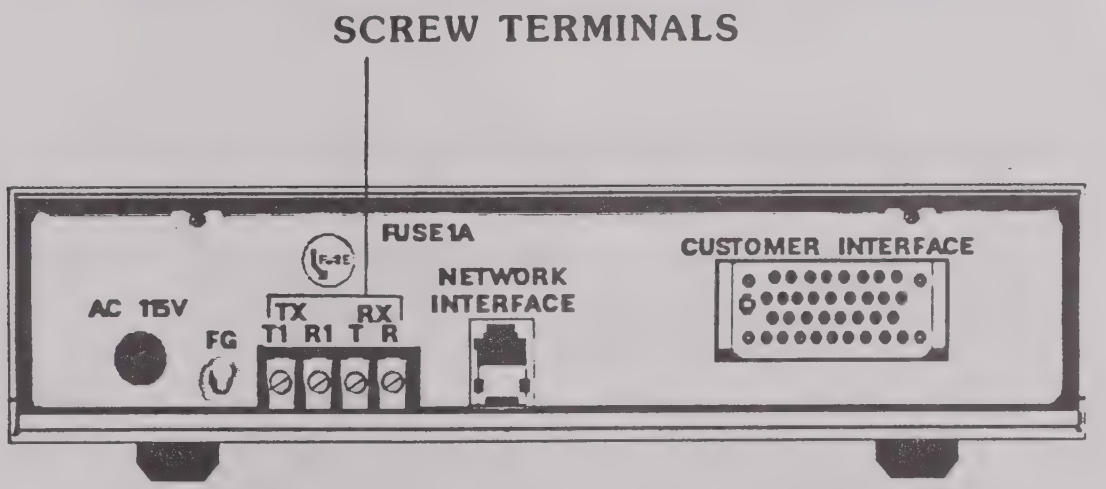


FIGURE 2.5 REAR PANEL

A frame ground terminal (labeled FG) is provided on the back panel to facilitate linkage to a common ground when the DSU/CSU is associated with other equipment (see Figure 2.5).

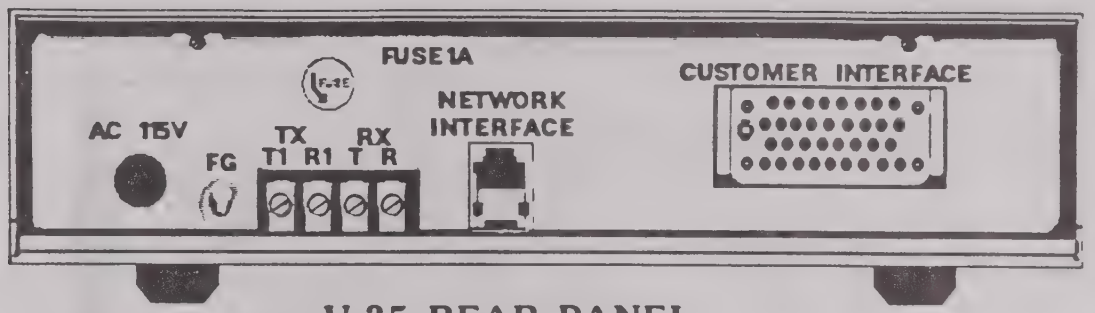
2.6 Circuit Card Replacement

Read this section only if you need to replace the N500A's interface circuit card. The unit is shipped with the interface card specified at the time of order.

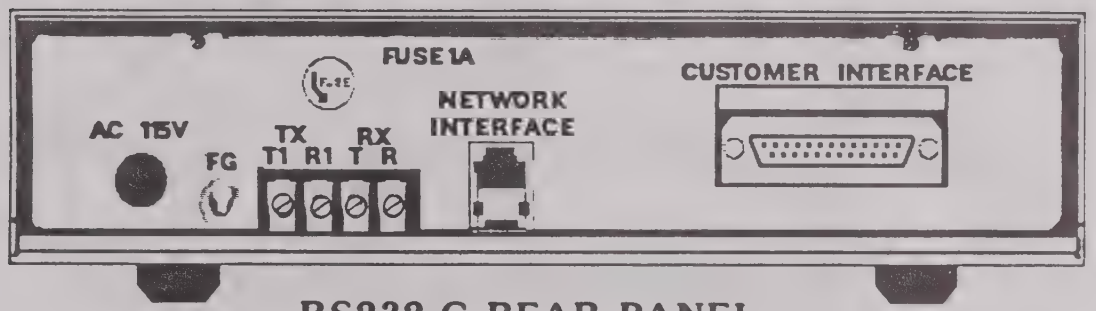
The following step-by-step instructions describe the installation of a CCITT V.35 circuit board in replacement of an RS-232-C circuit board. The steps are the same regardless of which circuit card is replaced.

Step 1. Be certain that the power cord to the DSU/CSU is disconnected.

Step 2. Verify current interface card type. Check rear panel "CUSTOMER INTERFACE". The interface connector is either the RS-232-C (25 pin) female connector or the CCITT V.35 (34 pin) female connector (see Figure 2.6).



V.35 REAR PANEL



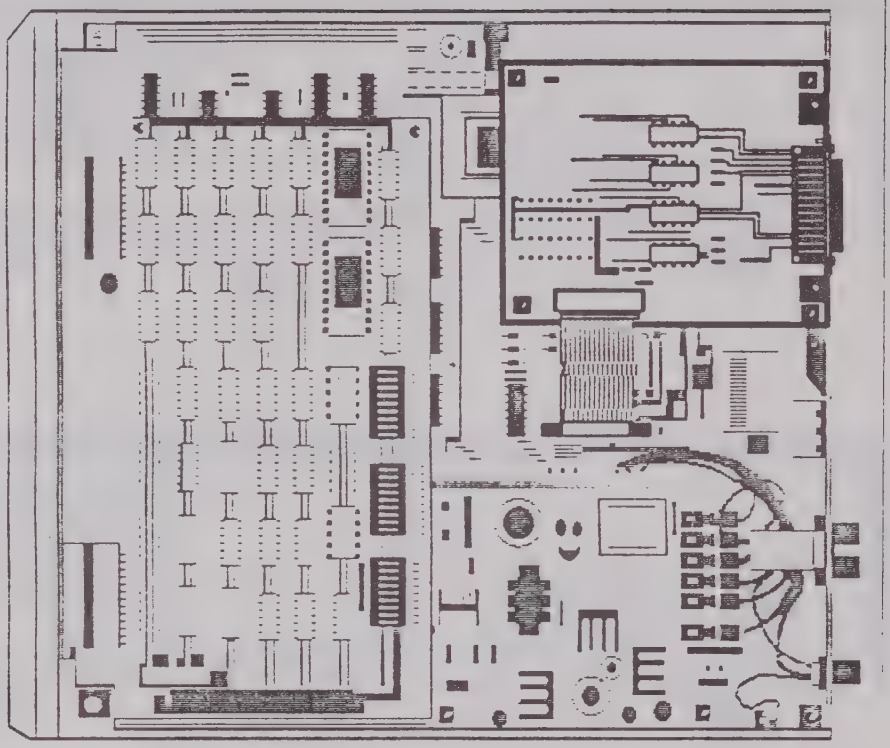
RS232-C REAR PANEL

FIGURE 2.6 CUSTOMER INTERFACES

Step 3. Remove the N500A cover. Loosen the two Phillips head screws on the back panel (Figure 2.3). Lift up and slide back the unit's cover to expose the electronic circuitry.

Step 4. Locate the currently installed interface card (Figure 2.7). The card is screw mounted to the left rear of the unit's main circuit board. Notice that the interface connector projects through the rear panel opening marked "CUSTOMER INTERFACE". A ribbon connector joins the interface card to the unit's main circuit board.

FRONT



REAR

FIGURE 2.7 RS-232-C INTERFACE CARD LOCATION

Step 5. Disconnect the ribbon cable joining the existing card to the main circuit board. Pressing down on the two wings of the plastic edge connector frees the cable from the main circuit board (Figure 2.8).

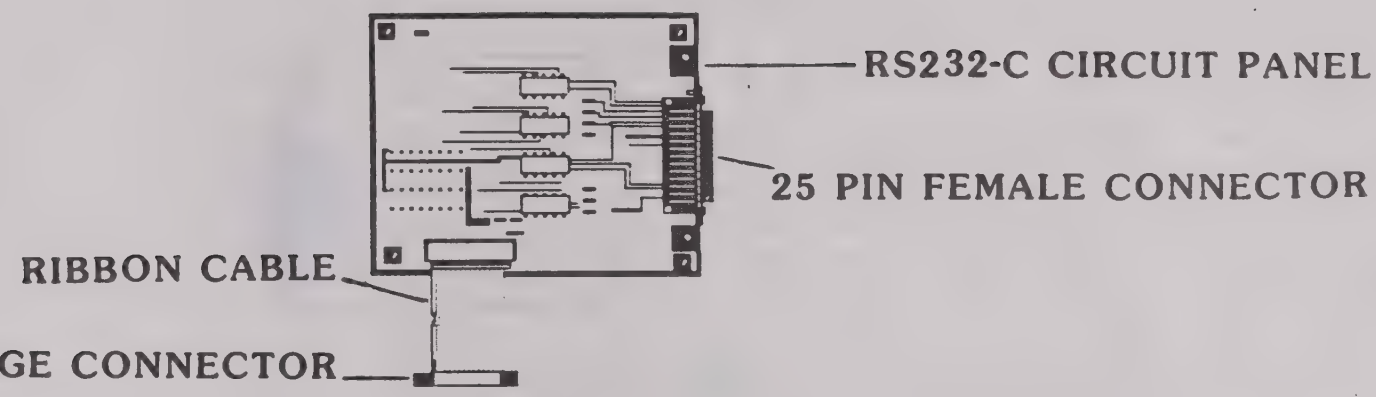


FIGURE 2.8 RS232-C INTERFACE CASE

Step 6. Using a Phillips head screw driver, carefully loosen and remove the four screws that secure the interface card to the main circuit board.

Step 7. Lift out the original interface circuit card.

Step 8. Mount the new circuit card (either RS-232-C or CCITT, V.35). Make sure that the interface connector projects through the rear panel opening marked "CUSTOMER INTERFACE" (see Figure 2.9).

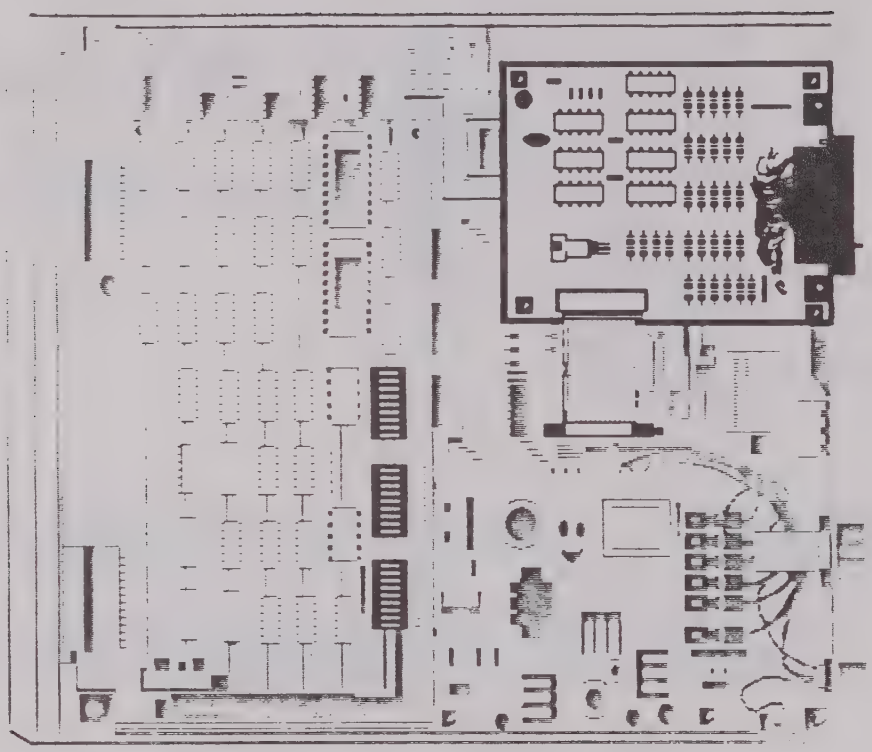


FIGURE 2.9 PLACEMENT OF V.35 INTERFACE CARD

Step 9. Secure the new interface card by replacing the four Phillips head screws.

Step 10. Connect the ribbon cable edge connector. Firmly seat the connector in the housing on the main circuit board. The plastic end wings will snap-lock into their closed position.

Step 11. Review and reset option switches to conform to the changed speed capability of the N500A. See Section 2.3.

Step 12. Replace the N500A cover and tighten the cover locking screws.

SECTION III
OPERATION

3.1 Overview

The N500A DSU/CSU is designed for automatic operation. Once the standalone unit is installed, communication is controlled from the data terminal equipment (DTE). System status and information pertaining to testing and diagnostics activity is displayed on the front panel.

3.2 Displays

The status of communications activity and testing activity, at the NN500A, is displayed on the front panel status indicators (LEDs) and the display window (LCD).

The LEDs (Section I, page 3) will light when certain conditions are in effect or when signals are received from the DTE.

Data rates and operation status are displayed in the Display Window (Table 3.1). The display is divided into four (4) sections or windows. In the display illustration (Figure 3.1), there are callouts identifying the four windows. You will note that these are for instruction only and are not actually silk screened on the unit.

Descriptions of the various messages that are displayed in the Display Window are given in Table 3.2.

Table 3.1
LCD DISPLAY WINDOW

Window	Information
A	Displays the word NORMAL to indicate normal operation or displays an active test mode.
B	Displays the selected test or shows that the display counter is reset.
C	Displays signal level or error count.
D	Displays the data rate.

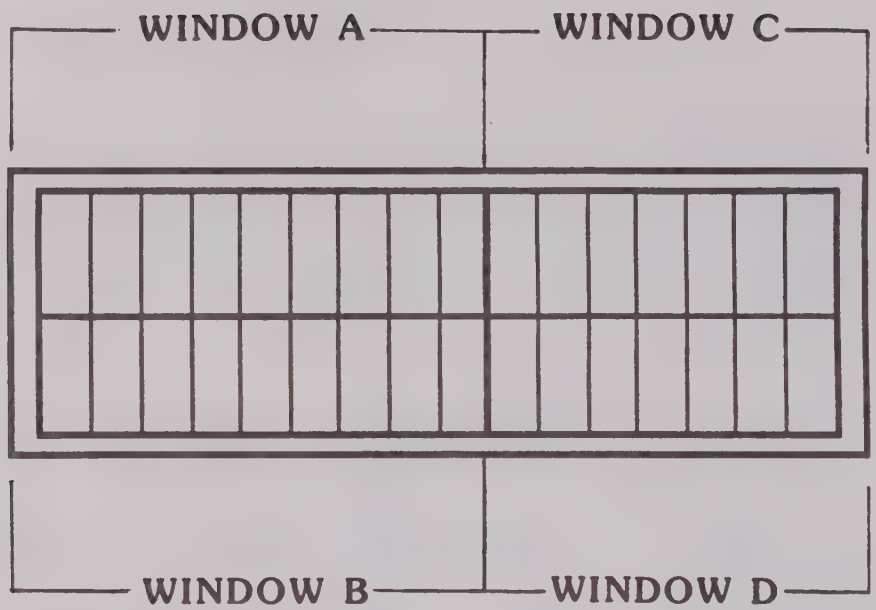


FIGURE 3.1 LCD DISPLAY WINDOWS

TABLE 3.2
LCD Display Messages

Window A

Message	Explanation
NORMAL	Indicates normal operation
	Remote Controlled Operations
RMT LL	Line Loop test active (DDS network request)
RMT RT	Remote Terminal test active (DDS network request)
RMT ST	Self Test active (request of remote DSU)

TABLE 3.2, N500A LCD Display Messages (Continued)

Window A (Cont.)

Front Panel Controlled Operations	
LCL LL	Line Loop test activated (SET)
LCL RT	Remote Terminal test activated (SET)
LCL AL	Analog Loop test activated (SET)
LCL ST	Self Test activated (SET)
LCL AL ST	Analog Loopback Self Test activated (SET)
Terminal Controlled Operations	
DTE RT	Remote terminal test activated by DTE interface.
DTE AL	ALB test activated by DTE interface.

CAUTION: The underline bar indicates that a test mode has been selected via the SEL button. (Test mode selection is non-disruptive.) The SET button activates the selected test and interrupts normal transmission.

Window B

Message	Explanation
Front Panel Controlled Operations	
LL	Line Loop mode selected (SEL)
RT	Remote Terminal mode selected (SEL)
AL	Analog Loop mode selected (SEL)
ST	Self Test mode selected (SEL)
CNTR RST	Displayed when SEL is pressed to reset counter after an error is displayed.

TABLE 3.2, N500A LCD Display Messages (Continued)

Window C

Message	Explanation
ERROR nn	Error count when unit is in self test. The two digit readout is a count of bit errors received during a test. The letters "OF" in place of the nn, signify an overflow (more than 2 digits, i.e. more than 99).
- nndB	In normal operating mode, shows received power signal level in the range of 0 to -44 dBM.

Window D

Message	Explanation
n.n Kb/s	Indicates one of four data rates selected (via hardware optioning): 2.4, 4.8, 9.6 and 56K bps.

NOTE: The data rate is selected when the N500A is optioned (see Section II) and thus does not change during normal operations.

For further information on the N500A's test capabilities, see Diagnostics, Section IV.

3.3 Normal Indications and Displays

When the N500A DSU/CSU is operating normally, the green LEDs are either lighted or, in the case of the RD and SD indicators, flickering. For a description of all nine indicators, refer to Section I, Table 1.1.

The unit's Liquid Crystal Display (LCD) contains the message "NORMAL" in Window A. A readout of the selected data rate is provided in Window D (see Figure 3.2). For a complete description of N500A LCD display messages, refer to Table 3.1.

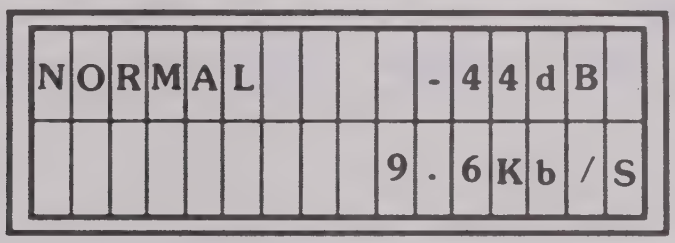


FIGURE 3.2 NORMAL LCD DISPLAY

3.4 Abnormal Indications and Displays

When the N500A is under test, normal operations are suspended and the units red 'TEST' LED lights, to indicate a selected test mode is active.

The red NS (No Signal) LED lights to indicate that the signal from the DDS or from the distant DSU has been lost. The NS LED also lights when the N500A is in a self test mode.

Terminal Disabled

When the RS (Request to Send) and the CS (Clear to Send) LEDs are not lighted, the terminal device is disabled or is not communicating with the N500A.

No Received Signal

When Window C displays the message -44dBm, the N500A is not detecting a received signal. A -44dBm reading is the lowest the unit can monitor. In such a case, the remote unit may be in local test and thus temporarily disabled.

Unit in Test

The message "RMT" in Window A signals that the N500A has been put into test by DDS Network Maintenance (Figure 3.3).

FIGURE 3.3 LCD, UNIT IN TEST

Section IV

DIAGNOSTICS

4.1 Overview

The N500A has extensive built-in diagnostic features allowing for a full complement of local and remote tests. A front panel Liquid Crystal Display (LCD) permits easy monitoring of equipment status, data transmission rate, and error performance while in the test mode. Six Light Emitting Diodes (LEDs) on the front panel identify control lead status.

Generally, testing of the DSU/CSU and the connecting circuit is performed by the telephone company's DDS Maintenance Staff. However, for customer engineered lines or to assist the telephone company, the N500A has the following local, remote and line test capabilities:

- o End-to-End Self-Test
- o Analog Loopback Self-Test
- o Analog Loopback Test
- o Line Loopback test
- o Remote Terminal loopback test
- o Multi-Junction Test
- o DTE control of local and remote tests

The N500A DSU's tests are controlled by push-button switches located on the unit's front panel.

> NOTE: If the N500A responds to a test command with a flashing LCD display, check to be sure the local unit has been assigned an address designator. The N500A does not perform tests unless an address has been assigned.

4.2 Local Tests

The N500A DSU/CSU employs three local tests:

- o Analog Loopback Self-Test
- o Analog Loopback Test
- o Line Loopback Test

> CAUTION: Once a local test is activated (using the SET button), communications are disrupted until test mode is released by pressing the front panel RST button.

Analog Loopback Self-Test

While the Analog Loopback Self-Test (AL/ST) is being performed, a self test pattern is transmitted and received internally. This test checks the performance of the local DSU but stops short of the unit's digital interface and the telephone line. Since the test is disruptive, inform remote site personnel before initiating the Analog Loopback self-test.

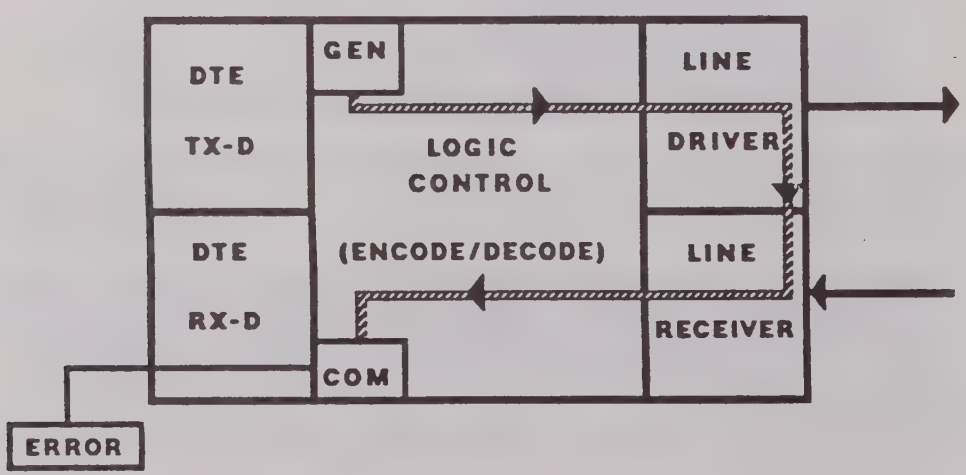


FIGURE 4.1 ANALOG LOOPBACK SELF TEST

To perform the Analog Loopback test, with the self test function, proceed as follows:

1. Press in the **SEL** button until LCL AL appears on the LCD display. Pressing the SEL button does not initiate the test nor does it disrupt data flow.

2. Press the **SET** button.

3. Press SEL again. This selects the unit's Analog Loopback Self-Test. Pressing SET once again activates the test. LCL AL ST is displayed. Notice that the AL readout on the LCD is moved to Window A.

4. Monitor the front panel Error Window (Window C) which provides a count of bit errors. If the error count exceeds "99", "OF" appears to indicate an OverFlow.

> **NOTE:** To reset the error count to 0 without disrupting a test in progress, simply press the **SEL** and **SET** buttons once again.

5. End the test by pressing the RST button.

Analog Loopback Test

The Analog Loopback test (AL) loops the N500A's transmitter to its own receiver. The test checks the N500A's digital interface (either RS-232-C or CCITT) and the unit's encoder and decoder. This test is used to check the local DSU/CSU and the terminal equipment together. The AL test does not test circuitry beyond the local DSU/CSU.

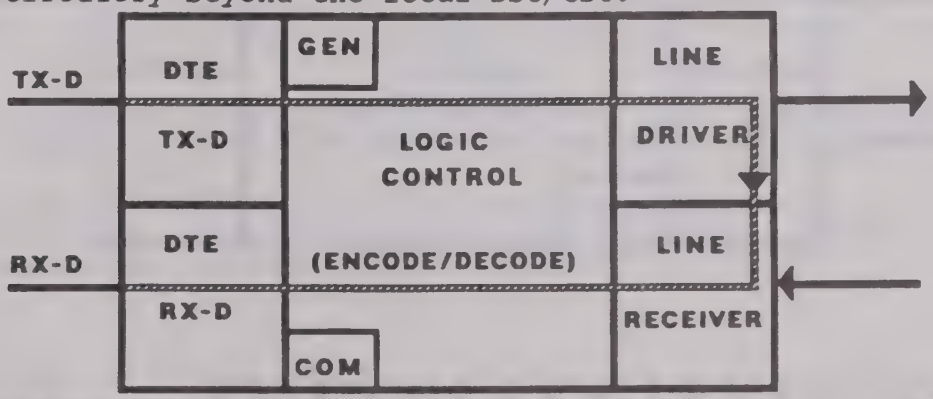


FIGURE 4.2 ANALOG LOOPBACK TEST

To perform the Analog Loopback test, proceed as follows:

1. Press in the SEL button until LCL AL appears on the LCD display.

2. Press the SET button to activate the test. Notice that the AL readout on the LCD is no longer underlined and is moved to window A.

4. Data or test patterns sent from the local DTE are looped via the local N500A back to the terminal. Discrepancies in sent and received data indicates either a defective local DSU/CSU or faulty terminal equipment including cabling. If an external bit error rate tester is used, monitor the tester's error count. Note that front panel LEDs operate normally. For example, SD and RD LEDs light appropriately.

5. End the test by pressing the RST button.

Line Loopback Test

The Line Loopback Test (LL) checks the local N500A's line driver and line receiver but stops short of the units encoding/decoding circuitry. The LL Test allows a remote DSU to test the telephone line and the local unit's line driver and receiver. The N500A's LEDS will be unresponsive because the encoding/decoding circuitry is bypassed. The distant DSU checks for transmission errors.

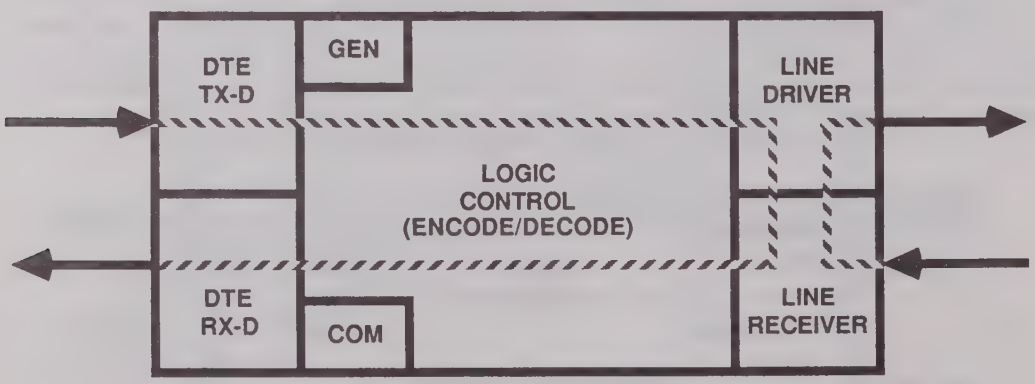


FIGURE 4.3 LOCAL LOOPBACK TEST

To perform the Line Loopback test (LL) proceed as follows:

1. Press in the SEL button until **LL** appears on the display.

2. Press the **SET** button.

3. Front panel SD and RD LEDs do not light under test. The distant DSU monitors for errors. If the LCD display flashes on and off or goes off altogether, the N500A has been unable to go into test mode. Check to be sure that the unit has been assigned an address.

5. End the test by pressing the RST button.

4.3 Remote Tests

When the N500A is connected to the DDS network, the phone company assumes responsibility for system maintenance. Thus, testing is ordinarily initiated by network maintenance. When the unit is under test, it should be remembered that normal communications are suspended. Under test, the modem displays **RMT** in the LCD's Window A.

The N500A's remote test features are provided to help the operator determine the cause of transmission trouble or to validate telephone company test findings.

Remote Terminal Loopback Test (RT)

The Remote Terminal Loopback Test is initiated from the local N500A DSU/CSU. It tests the remote unit, the line connecting the local and remote units, and the local N500A up to the digital interface (Figure 4.4).

This test requires an external test pattern generator from the DTE or a bit error rate tester at the remote site.

The test can also be used to initiate a local digital loopback test to simultaneously test the terminal and interface at the local site.

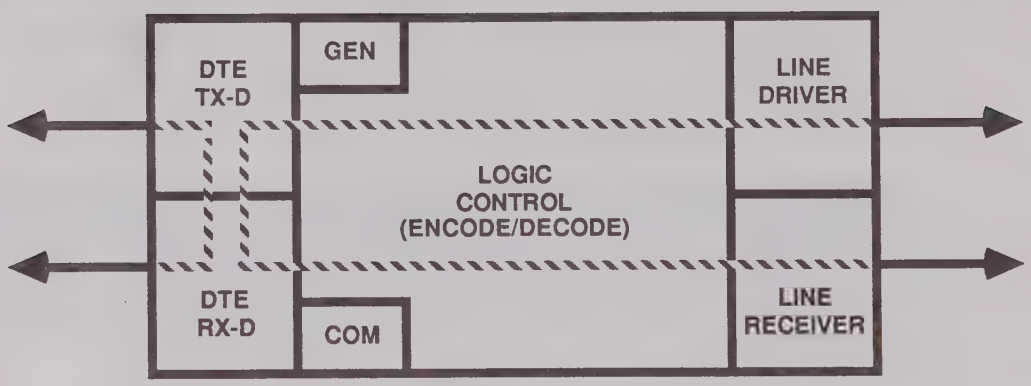


FIGURE 4.4 REMOTE TERMINAL TEST

To perform the Remote Terminal Loopback Test (RT) proceed as follows:

1. Press in the SEL button until **RT** appears on the LCD display.

2. Press the **SET** button.

3. Data or a test pattern is sent from the remote terminal (DTE) to the local DSU where it is looped back to the remote terminal. Discrepancies in received data indicate a defective circuit or a defect in either the local or the distant DSU/CSU. If an external bit error rate tester is used, monitor the tester's error count. Note that front panel LEDs operate normally at the remote site. For example, SD and RD LEDs light appropriately.

4. End the test by pressing the RST button.

End-to-End Self Test

An end-to-end self test is run when the N500A DSU/CSU is used on private lines or DDS circuits to test local and remote units as well as the connecting circuit. To conduct this test, both the local and remote units must have the same address.

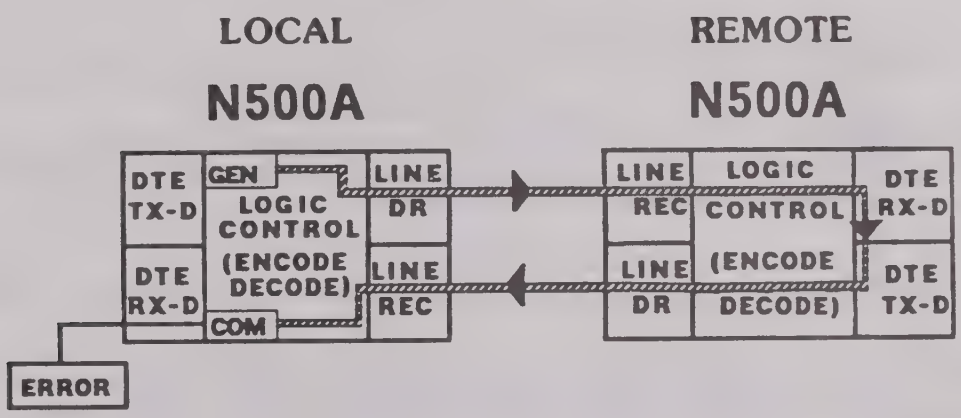


FIGURE 4.5 LOOP BACK SELF TEST

To Initiate the End-to-End Self Test:

1. Push the SEL button and repeat until ST is displayed.

2. Push the SET button.

   A test pattern will be sent to the remote N500A and bit errors will be looped back and monitored at the initiating N500A.

3. To reset the error number, press SEL and CNTR RST is displayed.

4. Then push SET button.

Multi-Junction Testing

In a multi-junction arrangement, the hub or central site can test each remote leg of the system. However, in order to test a troubled circuit, the remote unit must be addressed by the hub site unit. Addressing is accomplished by reassignment of option switches SW1 to match the address assigned to the selected remote unit. For further information on address designation, see Section 2.3.

4.4 Terminal Control of Testing

Some computers have incorporated sophisticated communications protocols that can evaluate the quality of a communications circuit. These protocols typically automate one or both of the following tests:

- AL test (to verify function of local unit)
- RT test (to verify function of line and distant DSU)

These tests are performed by controlling test function pins on the DTE interface (see Appendix B or C for the appropriate pin assignments). When under test, the local N500A shows the test selection in window A.

If your system has these capabilities, be sure options SW3-8 and SW3-9 have been set accordingly (see Section 2.3).

APPENDIX A

FCC Rules, Part 15

WARNING:

Federal Communications Commission (FCC) Rules require that you be notified of the following:

1. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications.

2. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

3. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct interference.

APPENDIX B

NEC RS-232-C

N500A 25 PIN Interface Connector Assignments

Interchange Pin	Circuit Ckt	Common No.	Name	Description
1	AA	101	Gnd	This circuit is tied to the DSU frame and back to the power supply system ground.
2	BA	103	SD	Sent Data: from the terminal to the DSU.
3	BB	104	RD	Received Data: from the DSU to the terminal.
4	CA	105	RS	Request to Send: a request from the terminal asking if it is OK to send?
5	CB	106	CS	Clear to Send: from the DSU to the terminal indicating that it's OK to send.
6	CC	107	DR	DSU Ready (Data Set Ready): from the DSU indicating the unit is in the data mode.
7	AB	102	Sig Gnd	Signal Ground: reference for interface signals, may be connected to DSU frame (GND).
8	CF	109	CO	Receive line signal detector: from the DSU, indicates a compatible incoming data carrier.
9	--	---	+12v	Reserved for Data Set Testing. +12v DC usually not extended to the equipment interface.

Interchange Pin	Circuit Ckt	Circuit No.	Common Name	Description
10	--	---	-12V	Test Voltage
11	--	---	---	Unassigned.
12	RT	140	RL	Remote Test. Initiates remote terminal loopback test.
13	--	---	--	Unassigned.
14	--	---	--	Unassigned.
15	DB	114	TX Clk.	Transmitter Signal Element Timing (DCE): transmit clock from the DSU.
16	--	---	--	Unassigned.
17	DD	115	RX Clk.	Receive Signal Element Timing (DCE): receive clock from the DSU.
18	LL	141	LALB	Local Analog Loopback: from terminal to DSU. Used to put DSU into local analog loopback test mode.
19	--	---	--	Unassigned.
20	--	---	---	Unassigned.
21	--	---	---	Unassigned.
22	--	---	---	Unassigned.
23	--	---	---	Unassigned.
24	DA	113	Ext. Clk.	Transmitter Signal Element Timing External (DTE): external clock from the terminal.
25	TM	142	TM	Test Mode Indicator: from DSU to terminal. Indicates that DSU is in test mode.

APPENDIX C
CCITT V.35 INTERFACE ASSIGNMENTS

Interchange Pin	Ckt	DTE TERM	DCE MODEM	Description
A	FG			Frame Ground
B	SG			Signal Ground
C	RS	->		Request to Send
D	CS		<-	Clear to Send
E	DR		<-	Data Set Ready
F	CD		<-	Received Line Signal Detect
K	LT	->		Local Test
P	SD(A)	->		Send Data
S	SD(B)	->		Send Data
R	RD(A)		<-	Received Data
T	RD(B)		<-	Received Data
U	SCTE(A)	->		Serial Clocking Transmit External
W	SCTE(B)	->		Serial Clocking Transmit External
V	SCR(A)		<-	Serial Clocking Receive
X	SCR(B)		<-	Serial Clocking Receive
Y	SCT(A)	->		Serial Clocking Transmit
AA	SCT(B)	->		Serial Clocking Transmit
CC	RT	->		Remote Terminal Test

NOTE: Unassigned pins are not listed.

HELP!

NEC DATA COMMUNICATIONS PRODUCTS

Use the following table to record the results of DSU tests.

Test \ Result	LOCAL DSU	REMOTE DSU	SYMPTOM
AL	☐ Pass ☐ Fail	☐ Pass ☐ Fail	
ALST	☐ Pass ☐ Fail	☐ Pass ☐ Fail	
ST	☐ Pass ☐ Fail	☐ Pass ☐ Fail	
RT	☐ Pass ☐ Fail	☐ Pass ☐ Fail	
LL	☐ Pass ☐ Fail	☐ Pass ☐ Fail	

Other Observations: _____

_____

NEC Model #	
NECSerial #	
Manufacturer and Model # of DTE	

Your Name: _____

Your Company: _____

Address: _____

_____

_____

_____

When you have completed this information, call NEC Technical Support:

(800) 538-8166 Continental U.S. (Exc. CA)

(800) 672-3309 California

(408) 433-1250 Outside CONUS

If you are instructed to return this DSU for repair, please enclose this card with the DSU, and mark the Return Authorization (RA) number given to you by Technical Support clearly on the top of the package.

RA #: _____

SHIP TO:

NEC America, Inc.
DCP
530 Brennan St.
San Jose, CA 95125

NEC

NEC America, Inc.

Data and Video Communications Systems Division

110 Rio Robles
San Jose, California 95134
(408) 433-1250